

Organizational Seminar:

Upcoming Grad Math Finance Students Research Presentations to the
GARP Calgary Chapter Steering Committee (April 2019) and to the
Calgary Business Community (May 2019)

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'Lunch at the Lab' Finance Seminar

November 6, 2018

Abstract

- We'll be discussing our plans for the semester of Fall 2018, and next semester, Winter 2019, with respect to the preparations of our Graduate Mathematical Finance Students Research Presentations (GMFSRP) to the GARP Calgary Chapter Steering Committee (April 2019) and to the Calgary Business Community (May 2019). I'll also present the information associated with our past experience pertaining to similar events, which include: the TMAC/PRMIA student event (Sept 20, 2006), UCalgary/PRMIA GMFSRP to the Calgary business community (April 10th, 2007), GMFSRP to the GARP steering committee (April 12, 2012) and GMFSRP to the Calgary Business community (May 8, 2012). Some possible research topics will be proposed and discussed.

Outline

- Targets
- Motivation
- Past Experience: The TMAC/PRMIA student event (Sept 20, 2006)
- Past Experience: UCalgary/PRMIA GMFSRP to the Calgary business community (April 10th, 2007)
- Past Experience: GMFSRP to the GARP steering committee (April 12, 2012)
- Past Experience: GMFSRP to the Calgary Business community (May 8, 2012)
- Some Research Topics
- Tentative Schedule of Upcoming GMFSRP at the 'Lunch at the Lab'

Targets

- Graduate Math Finance Students Research Presentations (GMFSRP) to Global Association of Risk Professionals (GARP) Calgary steering committee (April 2019):-10 best presentations from the 'Lunch at the Lab' talks will be selected (each talk for GARP committee is 5 minutes)
- GMFSRP to Calgary business community (May 2019): -3-4 talks will be selected by GARP committee for the Calgary business community presentations

Motivation

- I encourage you to participate in these two important events with your valuable presentations based on your research. It's a very good opportunity for networking, for internships and for future job in industry.
- I'll inform you about the exact dates of those two events probably in February-March 2019.

Past Experience

- Past Experience: The TMAC/PRMIA student event (Sept 20, 2006)
- Past Experience: UCalgary/PRMIA GMFSRP to the Calgary business community (April 10th, 2007)
- Past Experience: GMFSRP to the GARP steering committee (April 12, 2012)
- Past Experience: GMFSRP to the Calgary Business community (May 8, 2012)

Past Experience: The TMAC/PRMIA student event (Sept 20, 2006)

- **TMAC / PRMIA Student Event**
- **Where:** Scurfield Hall, Oak Room.
- **When:** 12:00 Noon, September 20, 2006 (approx. 1 hour duration)
- On September 20th 2006, the **University of Calgary** and the **Treasury Management Association of Canada (TMAC)** and the **Professional Risk Managers' International Association (PRMIA)** will be hosting a unique on-campus event to provide an overview of the financial industry's most interesting and dynamic career areas. This luncheon event will help to build an understanding of the corporate treasury function, the risk management role, and the growth opportunities available to students interested in becoming financial professionals.
- **TMAC** is Canada's only national association of treasury and finance professionals. With over 150 members, the Calgary chapter represents an unparalleled opportunity for students to learn side by side with highly placed finance professionals across a wide range of industry sectors. TMAC Calgary offers a student membership for \$20.00 per school year, or \$10.00 per semester which will give student members the opportunity to attend any TMAC Calgary event at a discounted price (free with corporate sponsorship). TMAC will also be introducing a new Student Ambassador volunteer initiative which will form solid relationships between students, and Calgary's financial community. More information can be found at: <http://www.tmaccalgary.com/>
- **PRMIA** is the Professional Risk Managers' International Association. Formed in January of 2002, PRMIA is the premier meeting place of the risk profession with more than 60 chapters around the world and over 30,000 members from more than 165 countries. A non-profit, member-led association of professionals, PRMIA is dedicated to advancing the standards of the profession worldwide through the free exchange of ideas. PRMIA offers the only globally endorsed Professional Risk Manager (PRM) certification program, pursued by over 1,500 active candidates in more than 80 countries, more than any other risk certification program. More information can be found at www.PRMI.org

Past Experience: The TMAC/PRMIA student event (Sept 20, 2006) II

- **Proposed Agenda:**
- **12:00 - 12:10**
- **University of Calgary Representative: Catherine Roy-Heaton, Haskayne School of Business**
- Brief overview of relationship between U of C academic programs, and the finance profession
- Introduction of TMAC and PRMIA Speakers
- **12:10 - 12:30**
TMAC Representatives: Karl Schamotta, Director of Programs and Jennifer Furgason
- Overview of Treasury
Overview of TMAC, and how it relates to students
Overview of Student Ambassador programme
- **12:30 - 12:50**
PRMIA Representative: Scott Dalton, Regional Director PRMIA
- Overview of Risk Management
Overview of PRMIA, and how it relates to students
Overview of PRM designation
- **Q and A Period**
- PRMIA members from TD Securities, EnCana and Enbridge will be there to meet students.

Past Experience: UCalgary/PRMIA GMFSRP to the PRMIA Calgary Chapter steering committee (April 10th, 2007)-Info

- April 10th, 2007 1:30pm-4pm
- Calgary, Alberta, Canada
Bankers Hall, West Tower (888-3rd St. SW), Room 811
- Organizers:
Scott Dalton, EnCana Corporation
Anatoliy Swishchuk, University of Calgary (Dept of Math & Stat)

Past Experience: UCalgary/PRMIA GMFSRP to the PRMIA Calgary Chapter steering committee (April 10th, 2007)-Agenda

- **1:30 – 1:45 Welcome and Session Overview: Scott Dalton**
- **1:45 – 2:00 Speaker 1: Hong Miao**
- **2:00 – 2:15 Speaker 2: Lenuglung Chan**
- **2:15 – 2:30 Speaker 3: Scott MacDonald**
- **2:30 – 2:45 Speaker 4: Greg Orosi**
- **2:45 – 3:00 Refreshments / Break**
- **3:00 – 3:15 Speaker 5: Yuyuan Ouyang**
- **3:15 – 3:30 Speaker 6: Lu Zhao**
- **3:30 – 3:45 Speaker 7: Xu Li**
- **3:45 – 4:00 Wrap up: Scott Dalton**

Past Experience: UCalgary/PRMIA GMFSRP to the PRMIA Calgary Chapter steering committee (April 10th, 2007)-7 Talks

- Hong Miao: VaR and CVaR: A Non-normal Regime Switching Framework
- Chan, Leunglung: Option pricing for GARCH models with Markov switching
- Scott MacDonald: Time Scale Decomposition of Economic Relationships Using Wavelet Analysis
- Orosi, Greg: Are Options Mispriced?
- Ouyang, Yuyuan: Swing option pricing under jump-diffusion model
- Lu (Matthew) Zhao: Variance Swaps for Mean-reverting Jump-diffusion Models
- Li Xu: Pricing Variance and Volatility Swaps for Stochastic Volatilities with Delay and Jumps

Past Experience: UCalgary/PRMIA GMFSRP to the PRMIA Calgary Business Community (October 11th, 2007)-3 Talks

- Greg Orosi: Implied Volatility Surface
- Hong Miao: VaR and CVaR: A Non-normal Regime Switching Framework
- Scott McDonald: Time Scale Decomposition of Economic Relationships Using Wavelet Analysis

Past Experience: GMFSRP to the PRMIA Calgary Chapter steering committee (April 12, 2012)-Info

- April 12, 2012 (Calgary, Alberta, Canada)
- Organizers:
Scott Dalton (EnCana) & Anatoliy Swishchuk (University of Calgary)

Past Experience: GMFSRP to the PRMIA Calgary Chapter steering committee (April 12, 2012)-10 Talks

- Dimbi Ramarimbahoaka: A stochastic discount function modeled by a finite state Markov chain and related asset pricing
- Ke Zhao: Generalization of the Black-76 formula: Markov-modulated volatility
- Kaijie Cui: Weather derivatives with applications to Canadian data
- Elham Negahdary: Taxonomy of Power Models
- Babacar Seck: Portfolio Optimization Subject to Market Risk Constraints

Past Experience: GMFSRP to the PRMIA Calgary Chapter steering committee (April 12, 2012)-10 Talks (cont'd)

- Nelson Vadori: Delayed Heston Model: pricing and hedging of volatility swaps
- Paul Obour: CRUDE OIL HEDGING STRATEGIES-An application of Currency Translated Options
- Matthew Couch: Variance swaps pricing with GARCH models
- Yang Liu: Equilibrium Models with recursive utility
- LiFeng Zhang: The geometric Markov renewal processes with applications to finance

Past Experience: GMFSRP to the Calgary Business community (May 8, 2012, Bankers Hall, Auditorium)-
4 Talks

- - [1. Ke Zhao: Generalization of the Black-76 Formula: Markov-modulated volatility, University of Calgary](#)
 - [2. Elham Negahdary: Taxonomy of Power Models, University of Calgary](#)
 - [3. Nelson Vadori: Delayed Heston Model: Pricing and hedging of volatility swaps, University of Calgary](#)
 - [4. Paul Obour: Crude Oil Hedging Strategies, University of Calgary](#)

Some Research Problems

- The following research problems are provisional, and oriented on our math finance students, including my MSc and PhD students
- One of the problems is from Industry
- Contact your supervisor to prepare your presentation based on your research

Some Research Problems:

- Stochastic Modelling High-frequency and Algorithmic Trading
- Modelling Big Data in Finance and Energy Finance
- Stochastic Modelling of Limit Order Books (LOB)/Markets
- Optimal Liquidation/acquisition Problems and Market Making in LOB
- Stochastic Modelling in Energy Markets
- Clean and Alternative Energy Applications
- Stochastic Modelling in Insurance and Actuarial Sciences
- Data Science and Applications in Finance, Insurance, etc.

Some Research Problems (Industry-related):

- There is also another opportunity to take part in one of the problems from industry: Modelling of Levy-based option pricing based on Tensorflow Google platform:<https://www.tensorflow.org>
- This is a research project proposed by one of the industry person from Cenovus. If there is any progress w.r.t. this project then there will be possibility for future internship and prospective job involvement.

Presentations Styles

- Your Research Results or
- Review of Some Relevant to Your Research Papers

Nelson Vadori's (PhD) Presentation: 5 slides (including title slide)!

Delayed Heston Model: Pricing and Hedging of
Volatility Swaps

Nelson Vadori

April 12, 2012

Nelson Vadori's (PhD) Presentation: 2nd slide

Delayed Heston Model

- ▶ **Motivation: past history of the variance in its diffusion (over some $[t - \tau, t]$)**
- ▶ Non-Markov continuous-time GARCH model in (Swishchuk, 2005):

$$\frac{dV_t}{dt} = \gamma(\theta^2 - V_t) + \alpha \left[\frac{1}{\tau} \left(\int_{t-\tau}^t \sqrt{V_s} dZ_s^{\mathbb{Q}} - (\mu - r)\tau \right)^2 - V_t \right]$$

- ▶ Drift-adjusted Heston model incorporating delay:

$$dV_t = [\gamma(\theta^2 - V_t) + \epsilon_{\tau}(t)] dt + \delta \sqrt{V_t} dW_t^{\mathbb{Q}},$$

$$\epsilon_{\tau}(t) := \alpha \left[\tau(\mu - r)^2 + \frac{1}{\tau} \int_{t-\tau}^t \mathbb{E}^{\mathbb{Q}}(V_s) ds - \mathbb{E}^{\mathbb{Q}}(V_t) \right],$$

Nelson Vadori's (PhD) Presentation: 3d slide

Calibration Results

- ▶ Semi-Closed formulas available for call options
- ▶ September 30th 2011 for underlying EURUSD on the whole volatility surface (14 maturities from 1M to 10Y, 5 strikes: ATM, 25D Call/Put, 10D Call/Put)
- ▶ **44% reduction of the average absolute calibration error: 46bp for delayed Heston, 81bp for Heston**

Nelson Vadori's (PhD) Presentation: 4th slide

Variance & Volatility Swap Pricing and Hedging

- ▶ Realized variance: $V_R := \frac{1}{T} \int_0^T V_s ds$
- ▶ $K_{var} = \mathbb{E}^{\mathbb{Q}}(V_R)$, $K_{vol} = \mathbb{E}^{\mathbb{Q}}(\sqrt{V_R})$
- ▶ Brockhaus & Long approximation: $\mathbb{E}(\sqrt{Z}) \approx \sqrt{\mathbb{E}(Z)} - \frac{\text{Var}(Z)}{8\mathbb{E}(Z)^{\frac{3}{2}}}$
- ▶ Using time-changed brownian motion representation for continuous local martingales, get closed formula for VarSwap and VolSwap fair strikes
- ▶ Closed formula available for hedge ratio

Nelson Vadori's (PhD) Presentation: 5th (last) slide

Main References

- ▶ Swishchuk (2005): *Modeling and pricing of variance swaps for stochastic volatilities with delay*
- ▶ Swishchuk (2004): *Modeling of Variance and Volatility Swaps for Financial markets with Stochastic volatilities*
- ▶ Mikhailov, Noegel (2003): *Heston's Stochastic Volatility Model Implementation, Calibration and Some Extensions*
- ▶ Kahl, Jäckel (2006): *Not-so-complex logarithms in the Heston model*
- ▶ Broadie, M and Jain, A. 2008: *Pricing and Hedging Volatility Derivatives*
- ▶ Brockhaus, O. and Long, D. 2000: *Volatility swaps made simple.*

Available Open Data Sources

- Lobster data
- Alberta Energy Data
- Lending Club
- Quandl

Open Data Sources: Lobster Data

- <https://lobsterdata.com/info/DataSamples.php>

Open Data Sources: Alberta Energy Data Webs

- <https://www.aer.ca/data-and-publications/statistical-reports/aeco-c>
- <http://www.gasalberta.com/gas-market/market-prices?p=pricing-market.htm>
- <http://ets.aeso.ca/>

Open Data Sources: Lending Club and Quandl

- Loan Data from Lending Club:
- <https://www.lendingclub.com/info/download-data.action>
- Quandl:
- <https://www.quandl.com/>

'Lunch at the Lab' Finance Seminar Webs

- Old one:
- <http://people.ucalgary.ca/~finlab/lunch.html>
- New one:
- <https://math.ucalgary.ca/finlab/lunch/archives>

Presentation Guidelines

- Tailor your presentation to your audience.
 - ◦ People will want to know how your research could be applied to benefit their organizations.
 - ◦ These organizations range from marketing and trading firms to energy exploration and production companies to energy utilities.
 - ◦ Examples and potential applications will be helpful.
- The atmosphere will be informal. The audience may ask questions during or after your presentation.
- You will not be graded.
- Please let the organizers know if there are confidentiality issues so the audience can be warned ahead of time.
- Casual business dress. Somewhere between neck ties (not necessary) and jeans (not recommended)
- Assume a university undergrad level of quantitative mathematics competence.

Tentative Schedule of the Upcoming GMFSRP at the 'Lunch at the Lab'-Fall 2018-Winter 2019

- **Aiden Huffman: 'General Compound Hawkes Processes in Limit Order Books'**, November 20, 2018, Tuesday, 12pm-1pm, MS 431
- **Alexis Arrigoni: 'Modelling the Fuel-Switching Price for The Alberta Energy Market'** December 4, 2018, Tuesday, 12pm-1pm, MS 431
- Any others?
- Winter 2019: talks-TBA; every second week; day, time and room-TBA

Thank you!

- If you have any questions-contact Anatoliy Swishchuk:
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- Q & A Time!